WASC 1582

W.71 434

Powerhouse A 210
Correspondence, Plates
Travelling Crane
Report

PHOTOGRAPHS

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Structural Perspectives

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Dear Mr. Wilson,

Please find enclosed a copy of our report on the overhead travelling crane at the Power House. We hope you will accept this as a personal copy as a token of our thanks for your help.

Regards

Ron Fitzgerald

BRIAN,

BOOK ON CRANES AS PROMISED

R Fitzgerald BSc, Phd . A Woodhead BSc

STRUCTURAL PERSPECTIVES . 48 Holdsworth Road . Holmfield . Halifax . HX2 9SZ . t 01422 240789 . f 01422 248785

HISTORIC MACHINE SURVEY

of the

OVERHEAD TRAVELLING CRANE,

in the

POWER HOUSE,

WALTHAM GUNPOWDER MILLS,

Powdermill Lane,

Waltham Abbey,

Essex.

Client:
The Royal Gunpowder Mills,
Powder Mill Lane,
WALTHAM ABBEY,
Essex,
EN9 1BN.

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Contents

HISTORIC MACHINE SURVEY

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OVERHEAD TRAVELLING CRANE,

in the

POWER HOUSE,

WALTHAM GUNPOWDER MILLS,

Powdermill Lane,

Waltham Abbey,

Essex.

Short Report on the Overhead Travelling Crane Servicing the Power House at the Royal Gunpowder Factory, Waltham Abbey.

The overhead travelling crane was inspected by R. Fitzgerald and G. Drake of Structural Perspectives Ltd., on behalf of the Waltham Abbey Gunpowder Mills Trust. The inspection took place on 13th July and consisted of an examination of the crane, compilation of site sketches, a limited amount of photography and discussions with the research staff who made available some relevant documentation.

Description.

The crane was installed as an integral part of the Power House Building, erected in 1915. The Power House accommodated three identical Robey, horizontal cross compound, piston drop valve engines, driving d.c. generators mounted on the high pressure side of the flywheel. The generators were supplied by Messrs. Bruce Pebbles and Co. Ltd. Two vertical high-speed engines were also housed within the Power House, one a triple expansion engine and the other a smaller, possibly simple expansion engine. The condensing plant for the engines was underfloor. A bank of switchgear was placed against the northern gable.

As it stands today, the Power House building is a steel-framed shed with brick curtain walls between the vertical rolled-steel stanchions located at 11' 3" centres. The stanchions support rolled-steel edge beams at each side of the building, which in turn carry triangulated steel trusses that make up the structural elements of the roof. The client, for the purpose of this inspection, copied drawings from the Trust's building archive. Drawing A 210 B 04, subsequently re-catalogued as AE-210/4, has a plant drawing number H 492 and is dated 26/6/1916. This appears to have been prepared as part of a proposal for a four bay extension to the Power House and shows the structural elements of both the older unit and the proposed extension. Although there are detail differences in construction, the buildings are largely identical in their main load bearing elements.

From the drawings and from the site inspection it is evident that the gantry frame for the travelling crane was designed with the building frame as an inter-dependent structural entity. Parallel to the structural stanchions, vertical, rolled-steel columns for the gantry are carried up from a common foundation baseplate. The crane verticals are riveted to the gusset plates of the foundation plate and cleated at three points to the structural stanchion itself. The gantry stanchions have a section of 9"x 7"x 0.375". Support for the crane side-rails is provided by a steel-joist runway consisting of 12"x 6" sections, joined over the stanchion heads by four bolt fishplates. The side-rails upon which the traveller runs are bridge rail section, 2¼" deep and 4½" wide over the foot flanges.

The traveller has a span of 28' 8" between wheel centres and is made up from longitudinals of 16" x 6" rolled section spaced at 3' 10" between web centres. The joists have rolling marks, indicating their origin to have been the Frodingham Iron and Steel Company. At either end they are connected by paired channels, placed back to back, the sections being 10" x 3½" and the have rolling mark Shelton. Double-flanged, cast-iron wheels are placed between the channels. Traversing is manual by gears and a shaft run to a chain pulley. Two cast-iron plates are mounted on the webs of the main span joists. One is inscribed BABCOCK AND WILCOX LTD., LONDON & RENFREW, CONTRACTORS, 1915 and the other, JOHN SMITH (KEIGHLEY) LTD., MAKERS, LOAD 10 TONS, 1915.

Steel channels form the side members of the chassis frame of the crab. These have a section of 15" x 4" and are separated by cast-iron channel sections of 10¼" on the vertical axis and 8" on the horizontal axis. The metal thickness is 0.75" and a gusset stiffens the section at midspan. The overall width between the outer faces of the steel side channels is 34.75" and the extreme length is 5' 1½". Cast-iron horn plates with fixed bearing bushes accommodate the axles of the travelling wheels. The axles are plain, turned all over, steel shafts of a uniform 2½" diameter whilst the cast-iron wheels are solid web discs with double flanges of 13" overall diameter. The wheelbase is 4' 2". The traversing motion is by a hand-chain wheel 26" in diameter driving the leading nearside wheel through a spur and pinion gear, respectively 6" and 24" diameter, giving a 4:1 mechanical advantage. The gears and the chain-wheel are overhung beyond the crab carriage and outside width of the traveller.

The lifting mechanism consists of a hand chain-pulley operating through a gear train to an underhung chain-barrel. The first motion shaft upon which the chain-wheel is mounted carries three gear wheels, numbered for the purposes of this report, 1, 2 and 3, of respectively, 14", 9½" and 4½" pitch diameters. Gear 1, the 14" diameter wheel and gear 2, the 9½" diameter wheel are change wheels working in conjunction with a second motion shaft carrying sliding pinions of pitch diameter 4½", gear 4, and 9½", gear 5. Meshed with gear 4, gear 1 gives a ratio of 1:3 and gears 2 and 5 have a unity ratio. The output drive from the first motion shaft is taken by way of the 4½" pinion, gear 3, to a 20" diameter gear on a third motion shaft, gear 6, a ratio of 4:1. This third motion shaft in turn carries a pinion, gear 7, of 7½" pitch diameter, driving the chain barrel axle gear wheel, gear 8, which has a pitch diameter of 37". The ratio between gears 7 and 8 is thus a 5:1 final reduction. Pinions 4 and 7 have single shrouds and pinion 3 has a double shroud. A ratchet adjacent to the chain-pulley prevents the load overwhelming the crane operator.

The hoist apparatus is suspended from the crab side frame members. Two steel plates are bolted to the channel webs and the 3½" diameter rope pulley axle spanned between bearings fastened to the lower extremity of these plates. Gear 8 ran on this axle and was directly attached to an 11" o.d. rope drum, grooved for the rope at 19 pitch. Clearance between the underside of the gear wheel, the lowest point of the crab and ground level is 20' 3" as at present day. A single fall pulley is enclosed within the drop block which has a forged wrought iron hook.

An Outline of the Development of the Overhead Travelling Crane.

The development of the overhead travelling crane was largely a response to the needs of the nineteenth century evolution of the engineering works although the first known examples have not been found in this context. An early version was operating in 1816 in John Rennie's Mahogany Sheds of West India Docks. These cranes loaded baulk timber from the stacks onto wagons, which ran on an internal plateway system. The cranes consisted of paired timber beams spanning the width of the shed forming a bridge across which the crab carriages traversed. The travelling mechanism for the crab carriage included a cast-iron rack fastened to the beams with which a pinion on the carriage engaged. Lifting was by a chain drum with a brake wheel and a lever and strap brake. The drum was rotated by a compound gear train with a ratchet on the first motion shaft. The cranes were a development of machines previously used by Rennie for the construction of Ramsgate Harbour.

A similar crane was installed in the Marc Brunel sawmills at Chatham, again used for the transport of baulk timber. The crane lifted the timber up a shaft from barges moored in a canal tunnel, which ran below the sawmill building. Having lifted the baulks clear of the tunnel eye, the crane was traversed along a gantry and the load deposited in a holding stack.

Both of these cranes had only one axis of travel but a drawing in the Goodrich collection entitled *Cross Section of Building with Overhead Travelling Crane and Presses* shows a crane that is capable of traversing the length of the building in addition to transversing the width. In this machine the travelling crab that features in Rennie's crane is absent and the top rope sheave only is tracked across the spanning beams. The rope barrel is situated in a suspended framework at the wall side and appears to be worked by a power system and gearing. Unfortunately this drawing is not dated but it is unlikely to be later than 1825.

Drawings of the above cranes show that two features that were later to characterise the overhead travelling crane had emerged by 1820. The Goodrich drawing shows a crane that travels the length of the building, running on elevated timber beams attached to the side-walls of the building. In contrast, the Chatham crane is carried upon a free standing gantry made up of vertical cast-iron columns and horizontal timber beams, the rails being cast-iron L-shaped plate rails.

By the mid-eighteen-thirties, the travelling crane had become sufficiently familiar to be a regular and unremarkable feature of railway construction. In the erection of the cast-iron arch girders of the London and Birmingham Railway bridge over the Grand Junction Canal, pairs of trussed timber frameworks were erected over the water and a primitive flat trolley carrying an A-frame crab ran from bank to bank. In the same year, 1837, a traversing crab combined with a travelling gantry was used in the construction of the iron bascule bridge over the Ouse for the Hull and Selby Railway. Thomas Cubitt used a gantry crane to build the Euston Arch in 1837 and similar cranes were active in the rebuilding of the Houses of Parliament.

Joseph Glynn, who had been the design engineer at Butterley Ironworks, writing in 1854, suggests that it was the Thameside marine engineers who may have first inducted the overhead travelling crane into engineering works. The marine engine was the largest and most complex machine of its day. The process of trial erection must have entailed considerable risk using the primitive jib cranes such as those known to have been employed in Maudsley's workshops in the first two decades of the nineteenth century. In the circumstances there must have been every incentive to improve lifting technology but the evidence is unfortunately incomplete.

John Glynn's contention that it was marine engineering that first made extensive use of overhead travelling cranes in engineering is supported by illustrations of John Penn's Blackheath marine engine works although the source is somewhat late, the *Illustrated London News* dating from 1865. Engravings of the erecting shop and the heavy machine shop show how the travelling crane had been integrated into the structure of the building. Both shops were entirely built from timber. The crane runs on a timber-framed gantry and both the traveller and the crab are of timber.

A similar beam and column structural form but substituting cast iron for timber can be seen in the Chatham Dockyard Number 7 ship building slip which was covered by a cast-iron framed shed in 1852. The resulting nave and isles format incorporated travelling cranes within the nave and over both isles. These cranes are of the fully developed pattern with trussed timber travellers and cast-iron framed crabs, one on each of the isle travellers and two on the longer nave span. The building was designed under Godfrey Greene as Director of Engineering and Architectural Works for the Admiralty, the chief assistant being William Scamp, under whom were three draughtsmen. Six years later, the same team was responsible for the Boat Store at Sheerness, again an iron-framed building with a large open nave served by travelling cranes.

Significantly, in both of the Admiralty buildings, the crane side rails are no longer carried by a free standing gantry but instead rest upon offsets cast into the vertical cast-iron, structural stanchions. Glynn commented upon this practice of incorporating the crane support structure into the fabric of the building:

> *".....In designing new buildings for steam engine manufacturers the side walls are now generally made of sufficient strength to carry a line of rails on an offset of masonry. On these rails rest two parallel frames of timber mounted on low wheels at each end.....so that the frames may travel along the building....on these frames a carriage travels....."*

By the time that Glynn was writing, in 1854, travelling cranes had become increasingly common in the better-equipped workshops of the engineering industry. The new erecting shop at E.B. Wilson's Railway Foundry in Leeds, opened in 1848, had travelling cranes over both bays, supported at the walls on pilasters but attached to a line of columns in the centre of the building. As engineer to the

Manchester, Sheffield and Lincolnshire Railway, Richard Peacock had installed travelling cranes at the works at Gorton in 1847. When he formed his partnership with Charles Beyer in 1854 to begin building locomotives privately, the new works of Beyer, Peacock and Company, also at Gorton, had several such cranes. Also in Manchester, both William Fairbairn's Canal Street Foundry and Joseph Whitworth's works were using travelling cranes by 1855. Outside Manchester, Richard Garrett's Long Shop in Leiston, Suffolk, built in 1853 for the completion and erection of portable engines made use of the nave and isle ground plan with a central open hall rising to roof level entirely surrounded by a continuous gallery. The outer walls are brick but the internal structure is almost wholly of timber. Timber storey posts forming a double column line dividing the floor into three transverse bays. These posts support the gallery floor beams, which extend from the side walls. Above gallery floor level, the posts continue upwards to terminate in a pair of crane track side-rail beams. The frame is braced with cast-iron brackets and the roof trusses are independent of the timber interior, resting only on the brick side walls.

****

The idea of applying an overhead travelling crane to facilitate the maintenance of large fixed items of plant and machinery rather than in a purely engineering product manufacturing situation seems to have originated with the horizontal steam engine. Prior to the mid eighteen fifties, the beam engine was the pre-eminent form of stationary steam engine and whilst it required periodic heavy lifts to service the bearings and repack the pistons, this was invariably achieved by a crab mounted at beam floor level and lifting eyebolts set into the ceiling beams at strategic points. The introduction of the large horizontal engine into the textile industry after 1855 seems ultimately to have led to the change to travelling cranes. As the horizontal engine had no intermediate floor level and as the arrangement of the engine components was horizontally distributed, the overhead travelling crane offered a more flexible option.

It is not clear at what point this took place. Illustrations of the first large horizontal engines tend to concentrate upon the power plant rather than its environment and engine houses are rarely included. As an alternative source of evidence, surviving examples of horizontal engine houses are also now rare but in at least two cases, the original lifting arrangements can be identified. The 1865 engine at Houldsworth's Mill, Reddish, retains the system used in beam engine practice, two parallel lines of lifting eyes set into the arched girders of the roof structure, both running for the full length of the engine house. Similarly, the Lee Bank Cotton Mill engine in Halifax, completed in 1868 by the Sowerby Bridge engine builder, John Wood and Company, relied upon eyebolts set into the ceiling beams. It would thus appear that the established beam engine house practice of fixed cranes persisted through into the first generation of horizontal engines.

The earliest recorded use of an overhead travelling crane in a horizontal engine house that has so far come to light is that shown in a George Watkins' photograph of G. Whittle & Company's engine at Stonebridge Mills, Longridge, Preston. The engine was supplied by Joseph Clayton and Company of Preston in 1877. Although relatively small by later standards, a tandem compound unit with cylinders

18" and 32" bore by 4' 6" stroke, Watkins' photograph clearly shows the side wall offsets and runner for an overhead travelling crane. Ten years later, Watkins' reproduces an engraving of the Astley Mill engine, Duckinfield, a two cylinder, cross compound of 1,300 h.p. with cylinders 32" and 60" bore by 7' 00" stroke in an engine house fitted with overhead travelling crane.

In the last two decades of the nineteenth century, the use of the reciprocating steam engine for electric power generation became widespread, led by the emerging central generating stations of private and municipal suppliers. The dynamos or alternators were variously driven directly or by ropes and belts but in either case, both engines and electrical equipment carried a high maintenance demand often compressed into short periods of shut down. The generating halls invariably included overhead travelling cranes, representing a significant extension of the market for the emerging specialist manufactures of such equipment. Power station work represented a major element in the order books of such firms as Henry Royce, Craven Brothers and the Leeds builders, Thomas Smith and Booth Brothers.

The Builders of the Waltham Gunpowder Mills Power House Crane.

The Waltham crane was supplied by the Keighley firm of John Smith and Company acting as subcontractors to Messrs. Babcock and Wilcox, Glasgow. Babcock and Wilcox's were primarily builders of water tube boilers. Their characteristic boiler had originated in patents of 1867 taken out by Herman Babcock and Stephen Wilcox in the United States. As it finally developed, the boiler was eminently suited to the high steam pressure and volume demands of electric power generation and by 1900, the company had worldwide manufacturing facilities. The main British works was established at Renfrew in Glasgow in the early eighteen eighties and thereafter Babcock and Wilcox dominated the United Kingdom generating station steam plant business.

The distinctive layout of the Babcock boiler gave rise to an equally distinctive boiler house design. This emphasised height rather than ground area and Babcock were quick to adopt commercial steel sections as they became available after 1886, to produce the skeletal steel-framed building as a cheap and readily built house for their boilers. As a consequence, they were amongst the first specialist steel-frame erectors although in this context their relationship with Redpath and Dorman Long requires further examination.

Although Babcock were almost exclusively known for their water tube boilers, the contract for the boilers at Waltham was not for the supply of this type of steam raiser but was instead for an installation of traditional Lancashire type boilers. The selection of this type of boiler over Babcock's own product was almost certainly due to considerations of the variable load imposed upon the generating machinery. Conventional shell boilers of the Lancashire type have a higher heat storage capacity due to the large volume of water that they contain. This water provided a store of energy that was released as the boiler pressure fell under load, liberating more steam from the water. The maker of the Lancashire boilers was the old established firm of Edwin Danks and Company of Oldbury, near Birmingham. Babcock and Wilcox had acquired Danks and Company in order to secure a means of penetrating that part of the market for steam generation equipment that was not suited to the water tube boiler. Thus, in all but name, the contract for both the boilers and the structural engineering of the boiler and engine house was awarded to Babcock.

The overhead travelling crane in the engine house was evidently regarded as part of the building structure contract rather than the power generating plant contract. For this reason the BABCOCK AND WILCOX LTD., LONDON & RENFREW, CONTRACTORS, 1915 maker's plate, referred to above, was attached to the crane. Babcock chose to subcontract the supply of the crane itself to Messrs. John Smith (Keighley) Ltd.

Messrs John Smith Ltd., was one of a number of firms that made up the recently emergent ranks of specialist travelling crane makers. Possibly, in part, as a result of the demand arising from electrical generating plants, between 1880 and 1910 a number of concerns were establishing reputations as

manufacturers of overhead travelling cranes. Usually, they had entered the engineering business as general engineers only subsequently to focus upon crane building, albeit frequently continuing to manufacture other products. Henry Royce, later to be associated with the Hon. C.S. Rolls, had followed this path in Manchester when in 1884 he began making electrical equipment from a small workshop in Cooke Street. Royce's superlative standard of craftsmanship and his inventive genius led to the sparkless drum wound dynamo and this in turn led to Royce manufacturing the first generation of electrically powered overhead travelling cranes.

John Smith and Company had entered the engineering trade twenty years before Royce, in 1866. Their activities were mainly directed at general engineering and millwrighting but at an early date they began to secure a name for woodworking machinery. This was extended into stone-sawing machinery of similar design and through this connection with quarrying, they embarked upon derrick crane production for quarry use. By 1898 they were undertaking derrick crane production for the better known firm of Thomas Smith and Company of Rodley, Leeds and at the turn of the century a total of 986 derrick cranes had been recorded in the firm's order book.

In 1902, Smith's built their first overhead travelling crane. This was despatched to a London customer, followed by the first electrically powered overhead travelling crane built for the Keighley steel foundry of Jonas Wells Ltd. Progressively, the woodworking machinery and stone machinery side of the business declined as Smith's concentrated increasingly upon overhead crane manufacture. It is a measure of their rapid ascendancy in this field that Babcocks should choose Smith's for the Waltham contract in 1915.

Smith's were to gain an increasing share of the overhead travelling crane market over the next half century. The firm had become a private limited company in 1900 and a new works was established between 1899 and 1907 at Bradford Road, Keighley. During the Second World War, the firm undertook the design and construction of specialist cranes for the erection of Bailey Bridges. In 1944, Smith's was acquired by Thos. W. Ward who carried out extensive development on the site in the immediate post-war period. This increased capacity led to the manufacture of overhead travelling cranes up to 150 tons lift and by a licensing agreement with the Italian firm Savigliano, Smith manufactured the single torsional box girder crane.

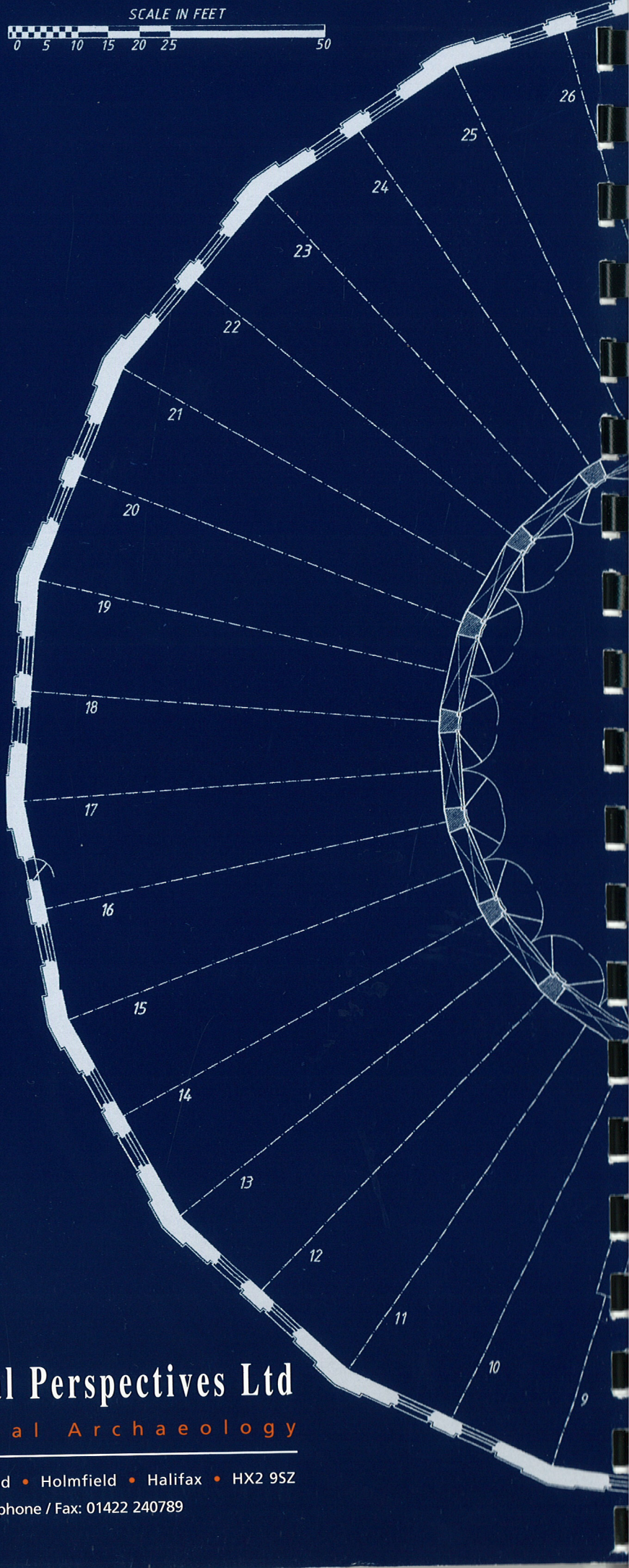
The dispersal of Ward's assets in the later nineteen seventies resulted in Smiths being purchased in 1978 by Norcros Ltd., of Reading, the holding company for Adamson, Butterley Engineering. For the next ten years, Smith's fortunes fluctuated with closure announced but rescinded on two successive occasions. Final closure came in March 1995 when the order book was transferred to the Butterley Engineering Company in Derbyshire.

Summary.

The Waltham Gunpowder Works Power House crane is of representative rather than unique interest. At the time that it was supplied, the overhead travelling crane was a well-established piece of technology and its use in power generating halls had been virtually universal for thirty-five years.

The mechanical features of the crane itself are generally unremarkable. The structure and mechanism have no exceptional qualities although the underslung lifting barrel merits further comment. In general overhead travelling crane practice, the lifting barrel is mounted above the crab frame. This results in an increase in the total headroom clearance required to run the crane beneath the roof trusses and correspondingly makes the total constructional depth of the crane, including the depth of the traveller somewhat greater than is the case at Waltham. This in turn requires a higher roof level. By suspending the lifting barrel underneath the crab part of the depth of the barrel mountings and the drum with its gear are included within the depth of the traveller girders, reducing the headroom clearance needed to pass under the roof trusses. In the Waltham case, the total constructional depth of the crane is 4' 9" of which 9" only (the gear wheel number 1 semi-diameter plus its bearing) is above the top flange of the crab side beams. The clearance under the roof trusses was estimated at 3". The remaining 4' 00" of the crab's construction depth is below the top flange of the crab side-beams and of this, approximately 1' 6" only lies below the bottom flange of the traveller girders and the net clearance above the engine house floor is accordingly improved.

John Smith and Company, the builders, were amongst the leading overhead travelling crane builders in Britain. Their products were formerly widespread but the wastage of the engineering industry and the supercession of the smaller electric generating plants has resulted in their products gradually disappearing. Two other examples are known to have survived within the last ten years but these may have already been disposed of. The firm's Keighley premises have been cleared to make way for a shopping complex and the Butterley Company has retained no records of the firm beyond those relating to the past forty years.



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John Wilson
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01279 426690
12/6/06

The Editor,
Old Glory,
Dear Colin,

I wonder if you would be interested in publishing the enclosed photo from 1908?

The photo shows the power station at the Royal Gunpowder Mills north site, with three Bruce Peebles 30VDC 200Kw generators on the right, note the nearest is running.
There are also three smaller generators on the far left of unknown make.
Note the nearest has had its generator removed, or is it waiting for it to be fitted? Our archive throws no light on this.
All though the photo was taken in 1908, the generating plant was installed some time in the late 1880s to replace the individual twin cylinder compound beam engines that were used to drive the various machines around the north site.
Steam was supplied by fifteen Lancashire Boilers 30ft x 8ft in size, delivering steam at 100psi. The boiler house supplied steam for heating and explosive processes through out the northern site as well as for powering the generator house.
There were two 30hp Compound beam engines which were supplied by Benjamin Hick & son between 1856 and 1861. A further three, of unknown make were supplied between 1867 and 1888 all five engines being installed to drive individual mills for the production of Cordite, though originally to incorporate (mix) gunpowder.
There was a small beam engine of unknown size or make, though since it was installed at the same time as the first of the Benjamin Hick engines, I would assume it was by the same maker, and was used as a backup to a water mill that incorporated (mixed) Gunpowder up till the start of 1941.
There were at least two engines of unknown type used to drive fans for the various drying stoves around the site and one to drive the hydraulics for two accumulator towers and their associated press houses.
So as you can see, the introduction of a central power house did away with lots of individual, labour intensive beam engines, as each engine had its own boiler house and staff.
Sadly non of the beam engines survived the changeover to electricity, any more than the generating plant survived the change to the national grid.
Ah well, such is progress.

I have emphasised the northern site in the above description, because in 1885 land was purchased to the south of Waltham Abbey to build a new chemical explosives factory, which had its own power and boiler house, the only link with the north site being an 18inch (hand pushed) narrow gauge railway. Petrol/Paraffin and battery locos not being introduced until 1916.

I enclose two photos of the power house as it now is.
Photo 1 shows the Northern elevation. Not the tower to the left of the main building.

This is one of the two accumulator towers for hydraulic power on the site. Looking at the main building, the narrow bay to the left is the generator house, the two wider bays (which are actually one building) to the right are the boiler house. Note the canal running along the back of the buildings.

Photo 2 shows the southern elevation with the generator house extending out beyond the boiler house. The road in the foreground is relatively modern, and would have been a canal basin to bring coal into the boiler house in its hay day. Evidence of the basin can still be seen close to the building.

One final item of interest, there is a very old manual gantry crane still in the generator house, and from the angle of the internal photo, I think the photographer was standing on the crane. The heavy girder to the right and above the generators is one of the tracks for the gantry.

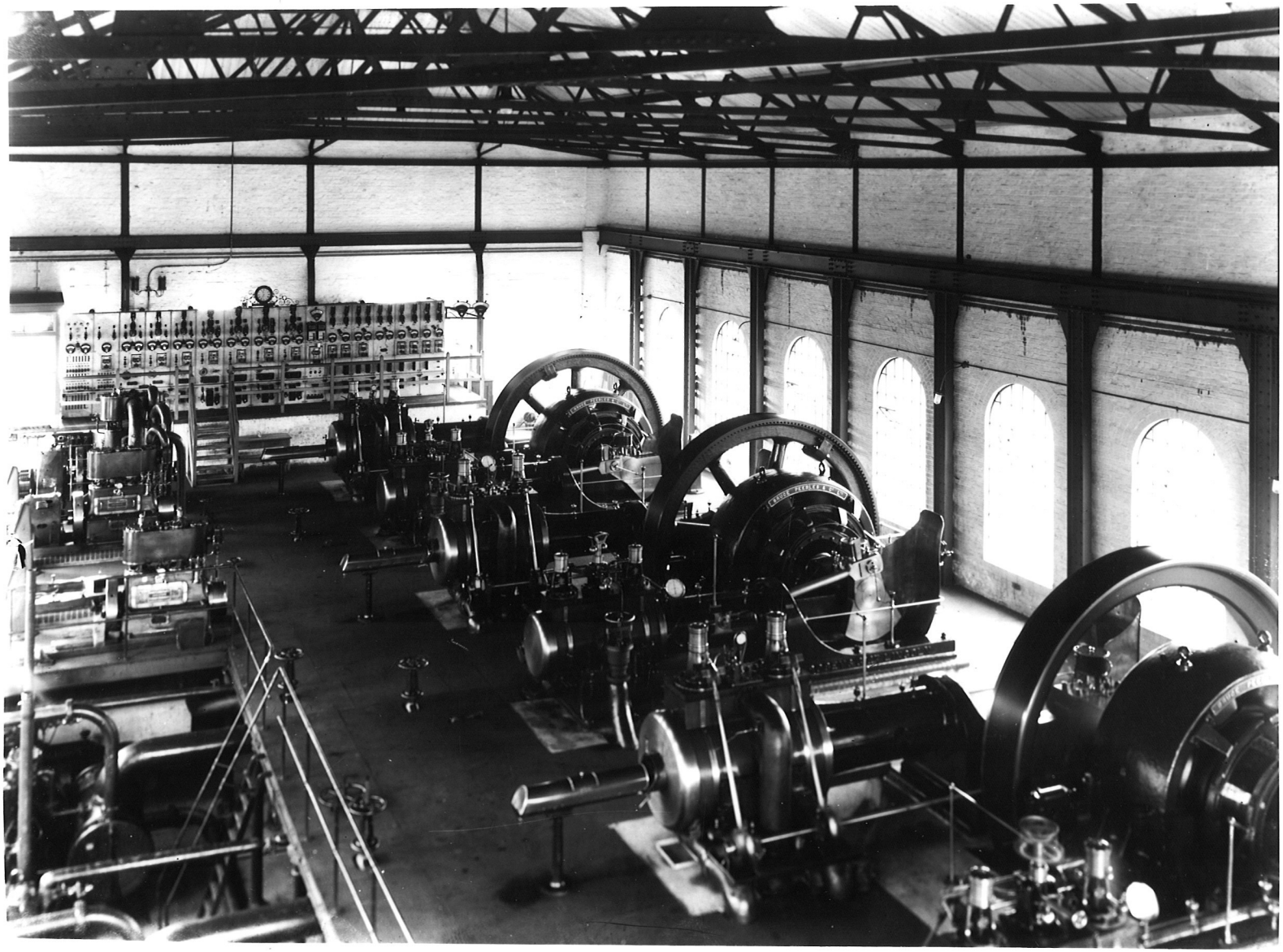
My thanks to Les Tucker, our volunteer Archivist, who loaned me the main photograph and supplied the boiler and generator information.

All photos other than the main one, taken by myself.

Photos & text are also on the enclosed CDR disc, which I would like back at your convenience.

Yours Sincerely,

John Wilson
Volunteer for the Royal Gunpowder Mills.

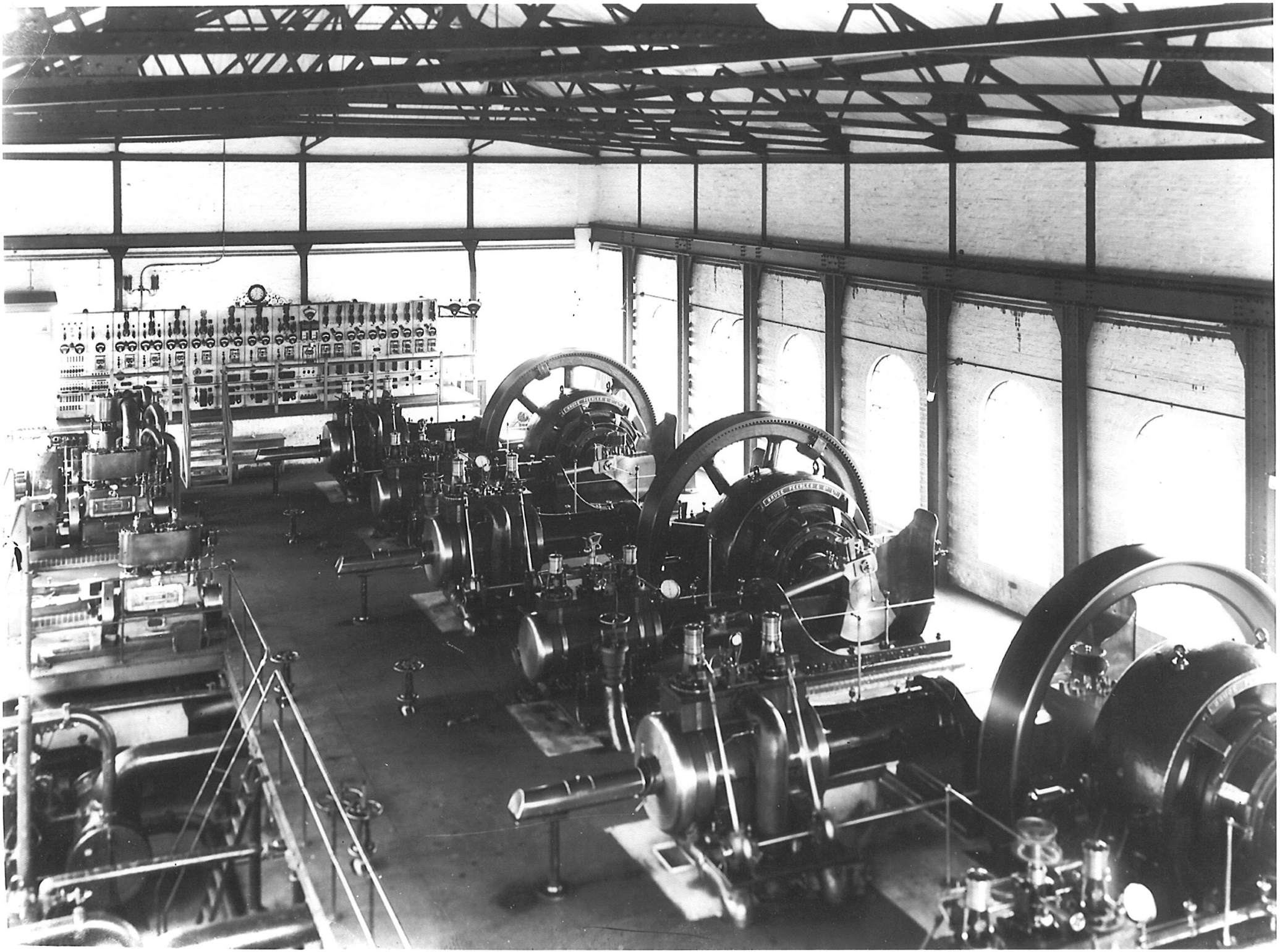


1582.

RCHME Report 1993
P. 153 states

'Though the building drawings are dated 1915, a contemporary photograph of the interior (TNA Supply 5/861, No. 237) showing three generators by Bruce Peebles & Co. Ltd. is dated 1908.'

C48



POWER HOUSE PHOTO OF
1908 SHOWING 3
BRUCE PEEBLES DC
GENERATORS ON THE
RIGHT WITH 3 SMALL

GENERATORS ON THE FAR
LEFT.
NOTE THE NEAREST OF
THE THREE SMALL ENGINES
HAS NO GENERATOR FITTED,
WHILE THE NEAREST

BRUCE PEEBLES MACHINE
IS RUNNING.
PHOTO 1582
RCHME REPORT 1993
P. 153.

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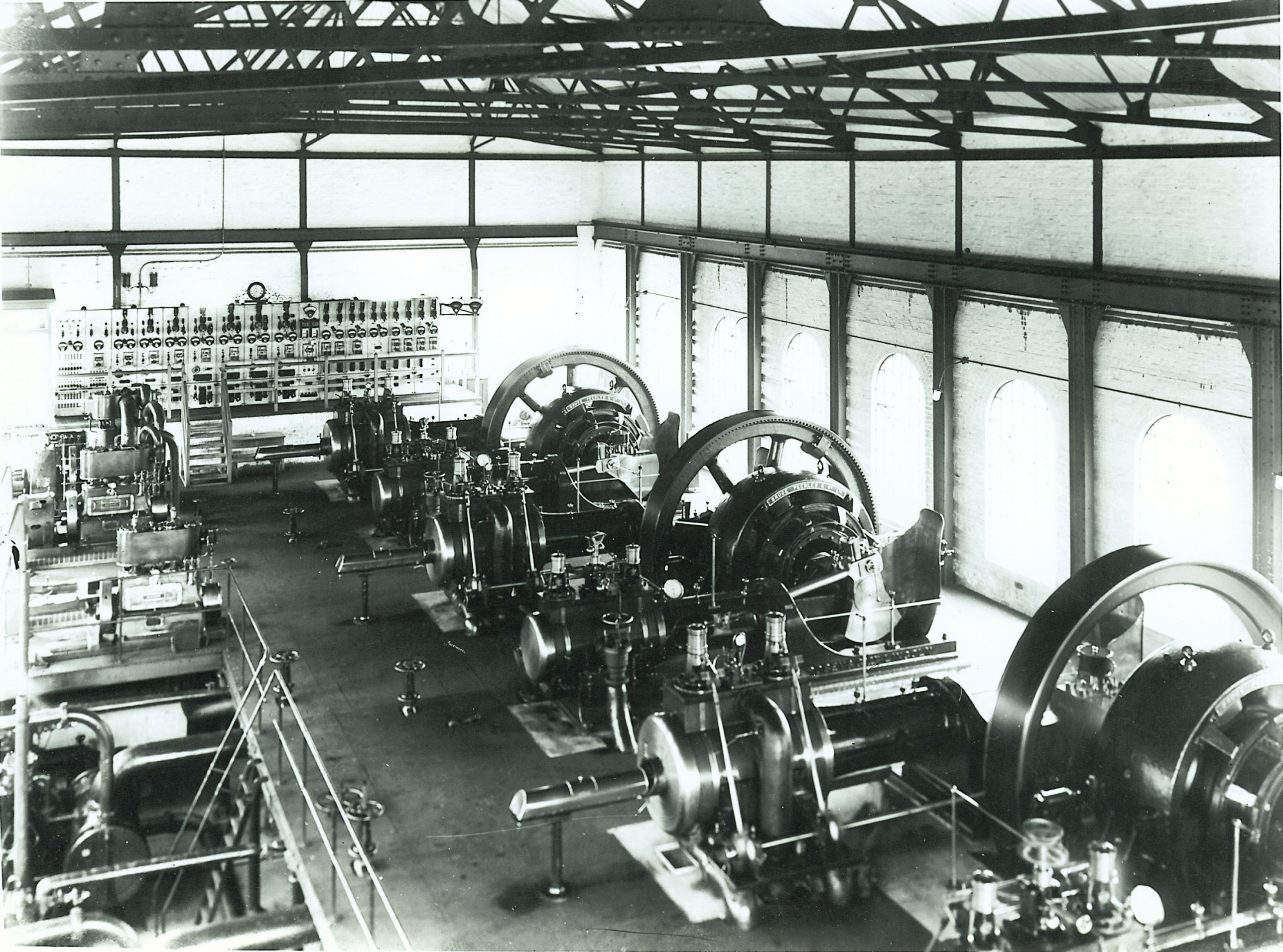
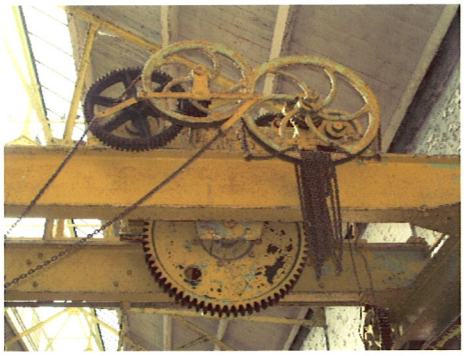
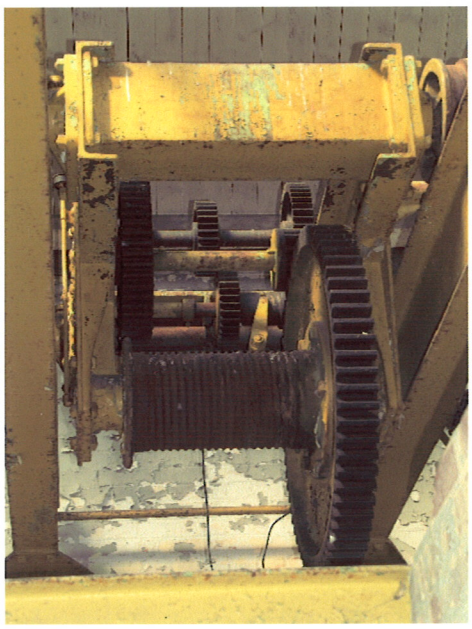


The Boiler House

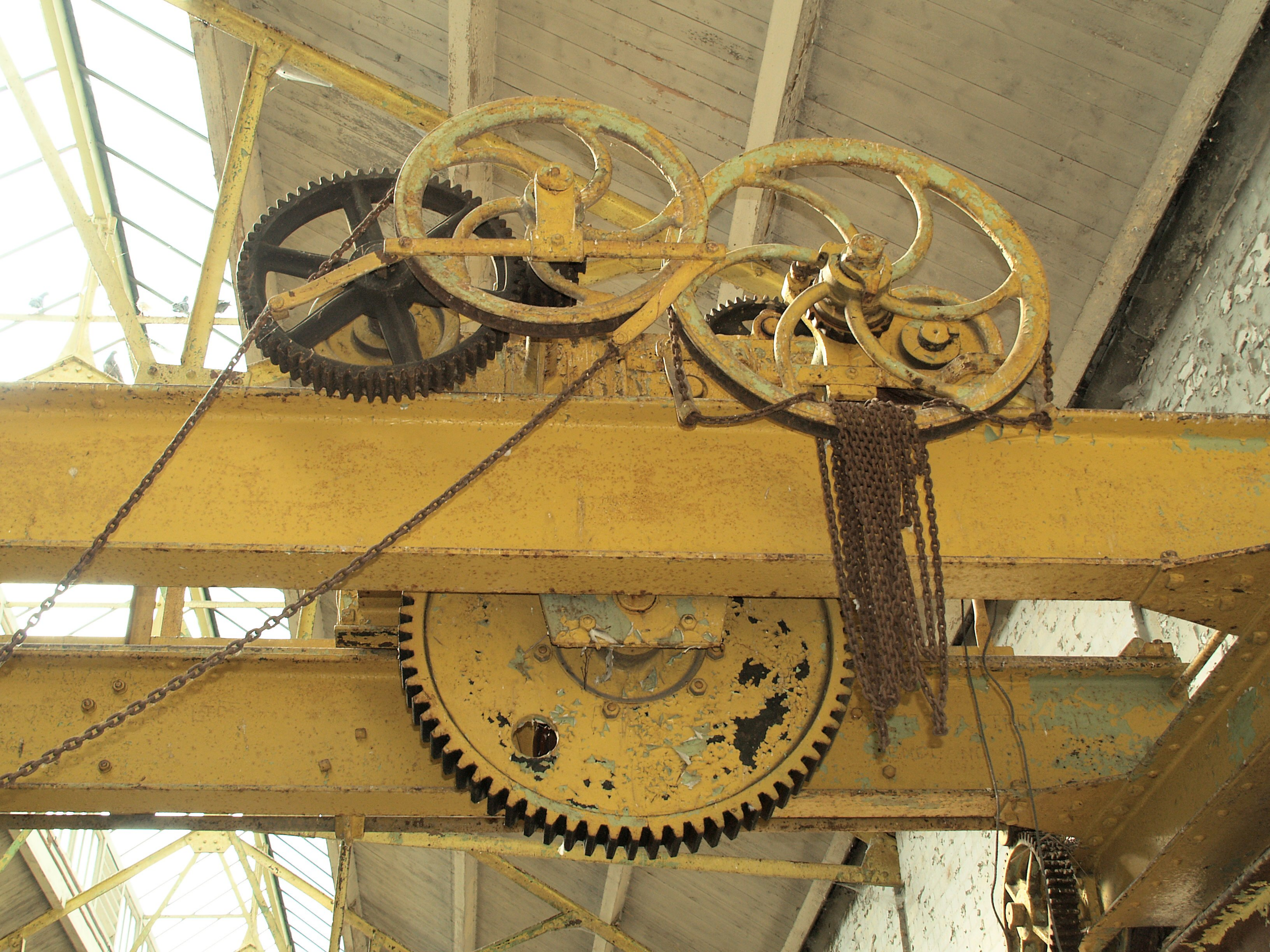
Powerhouse3



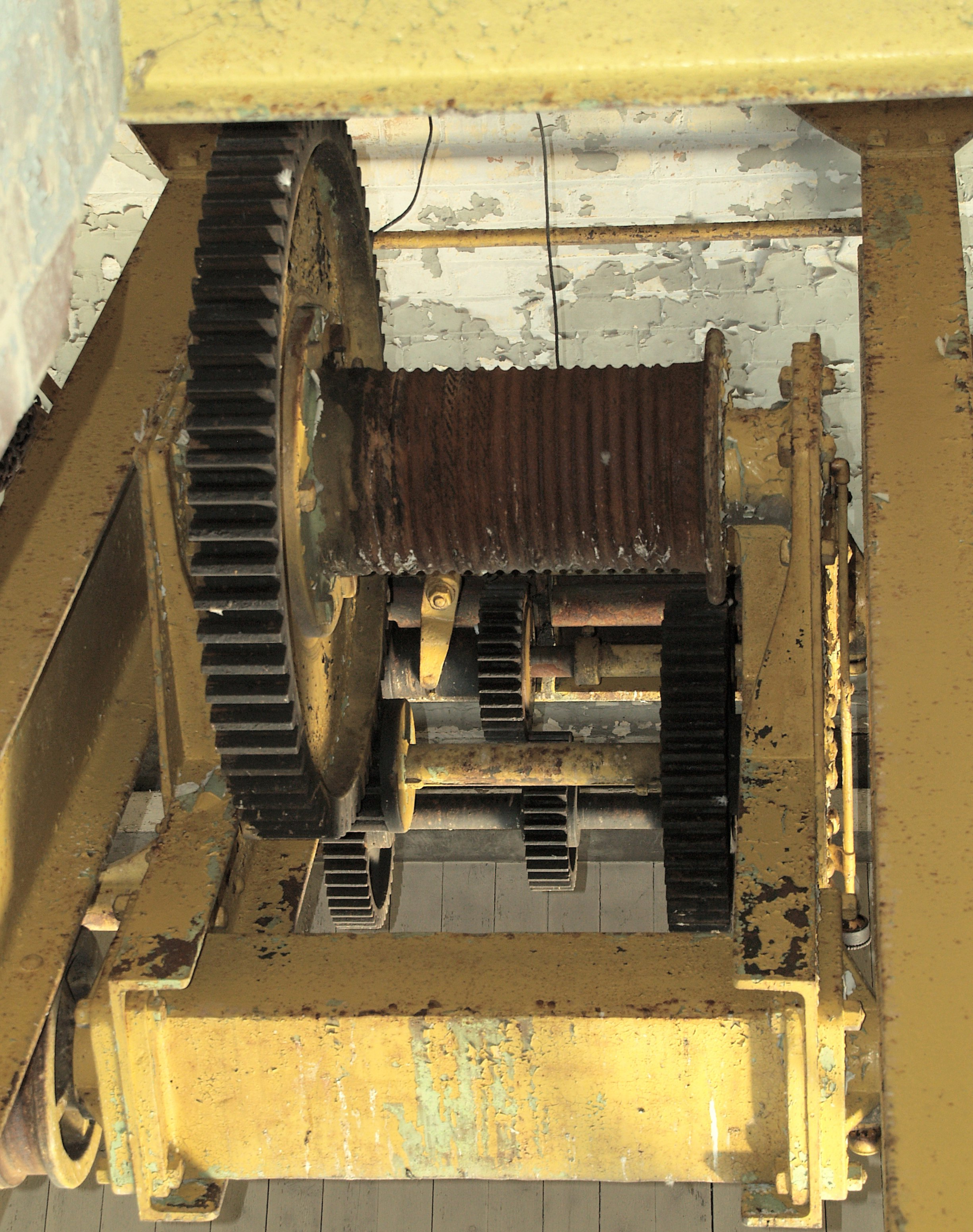


The two makers plates

Verious views of the crane



BABCOCK & WILCOX LTD
LONDON & RENFREW
CONTRACTORS
1915



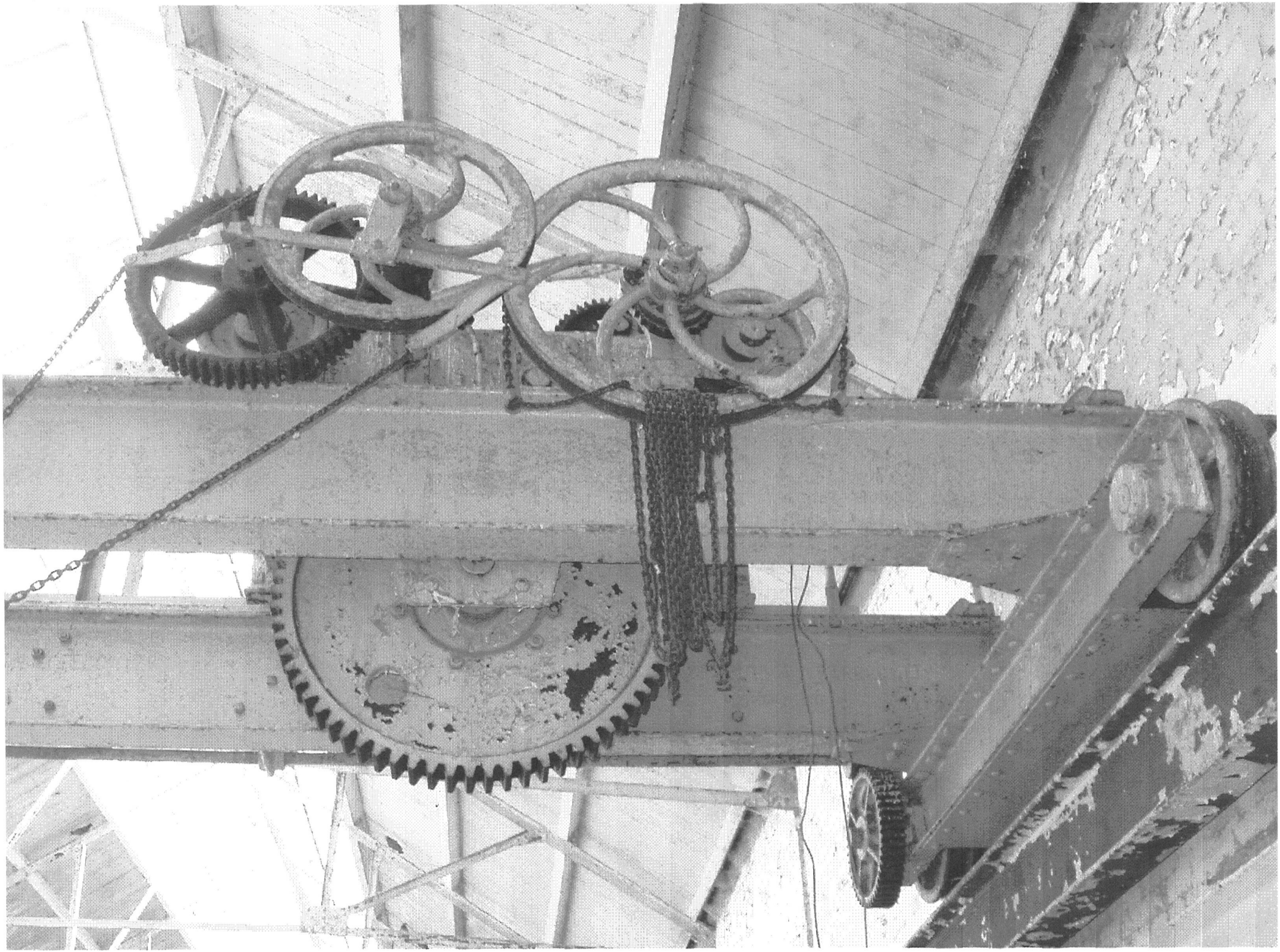
JOHN SMITH (KEIGHLEY) LTD
MAKERS
LOAD 10 TONS
1915

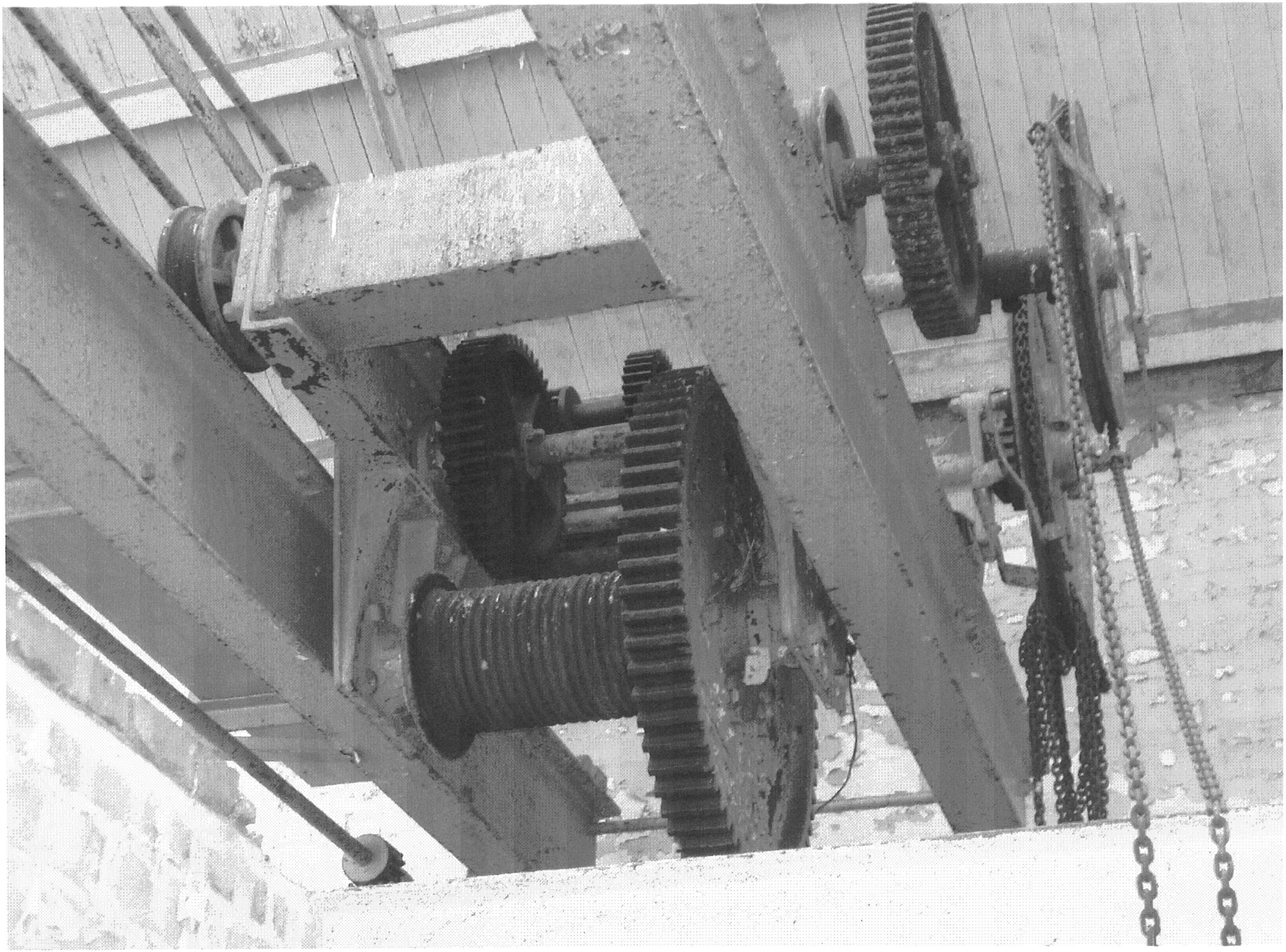

VAUXHALL
N714 LGS

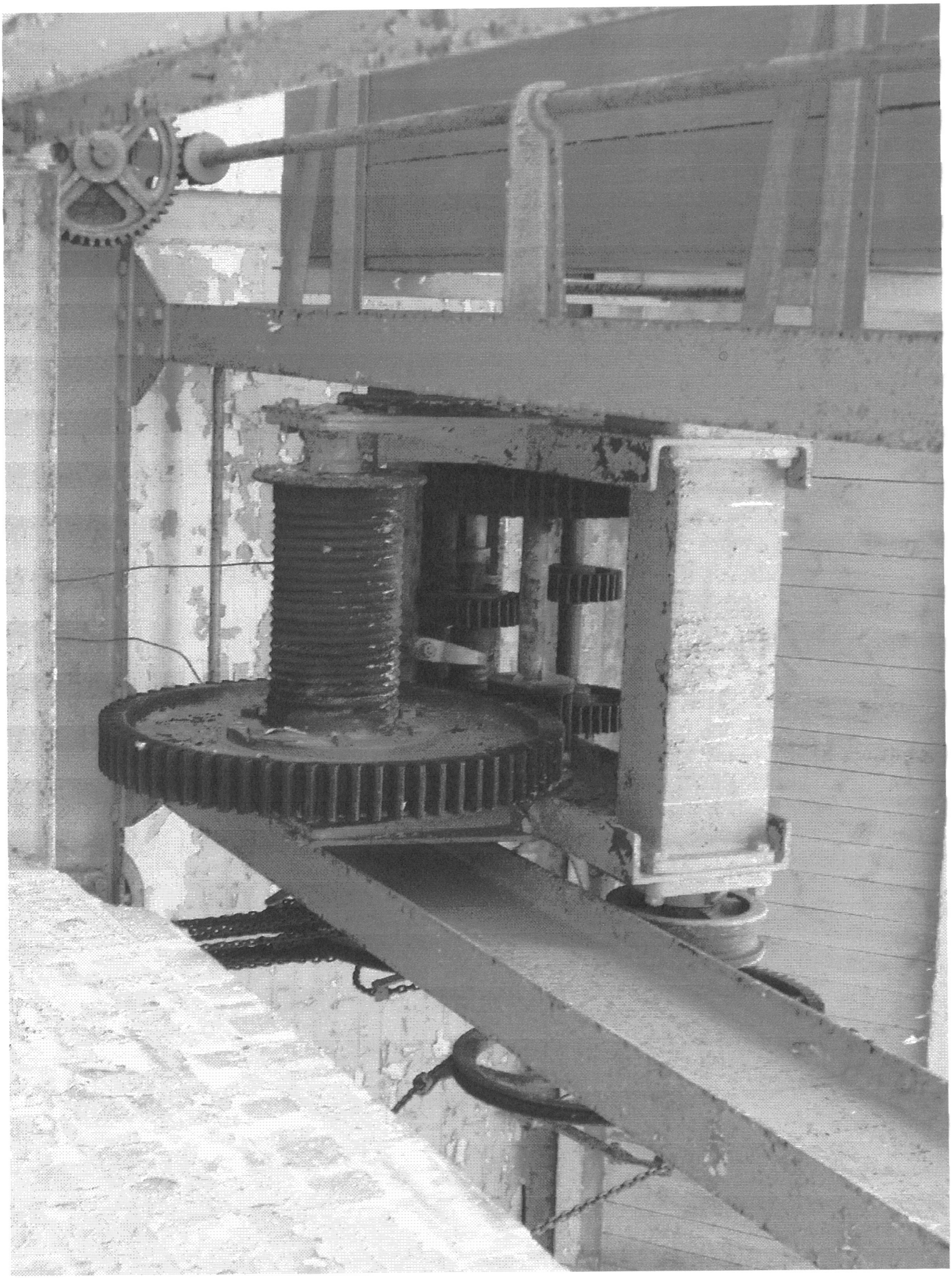

BABCOCK & WILCOX LTD
LONDON & RENFREW
CONTRACTORS

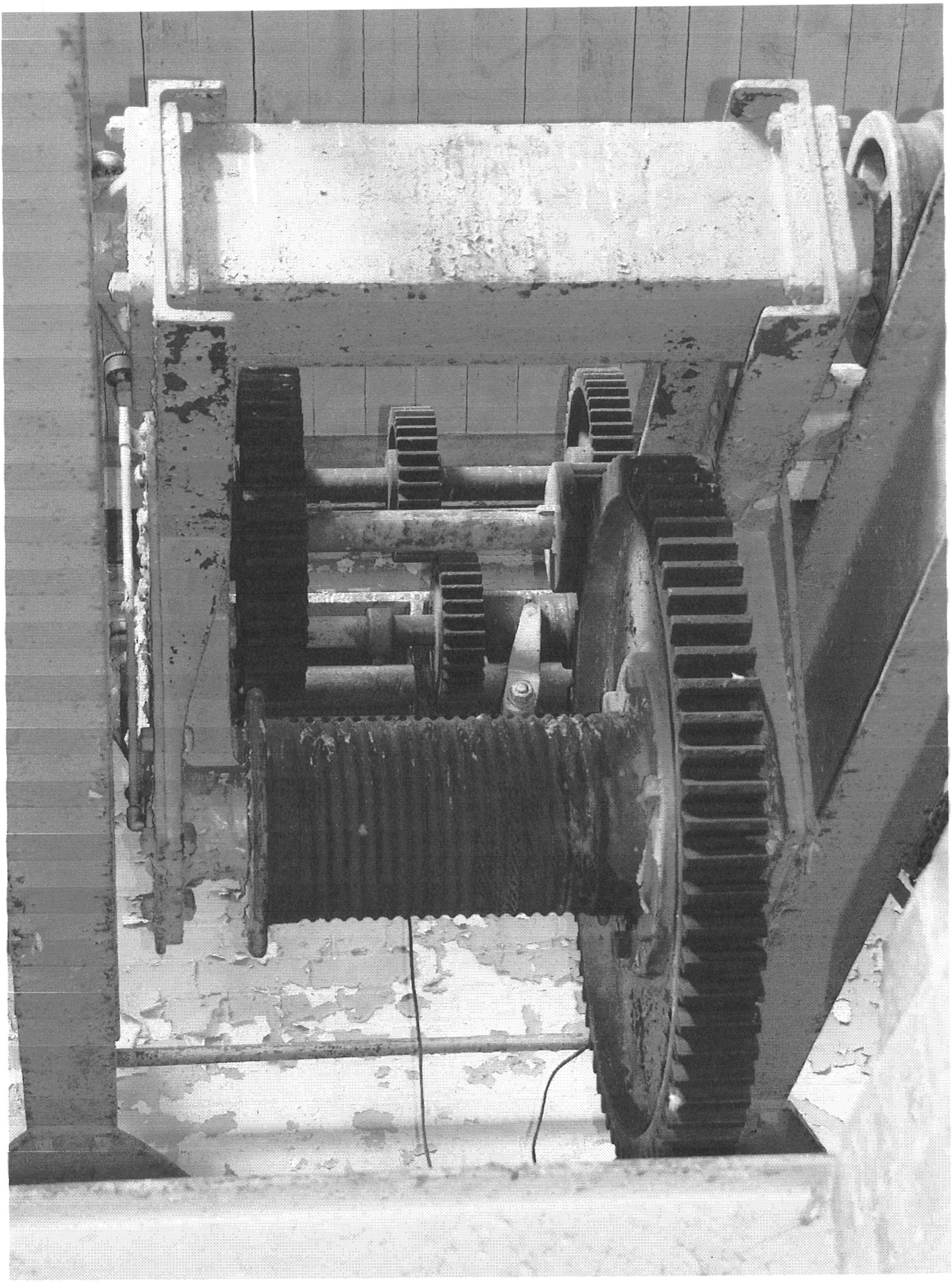

JOHN SMITH (KEIGHLEY) LTD
MAKERS
LOAD 10 TONS
1915

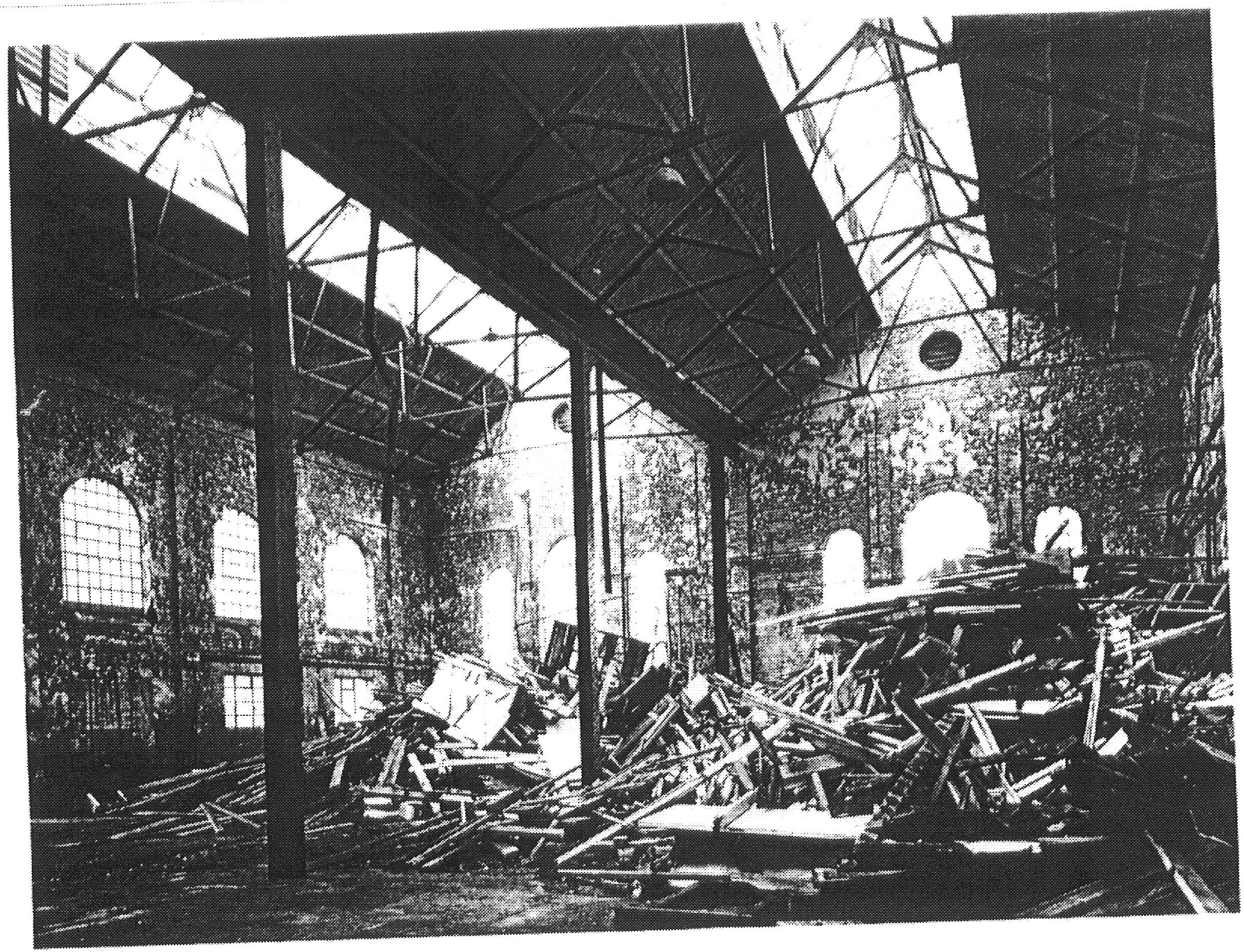

ENGLAND

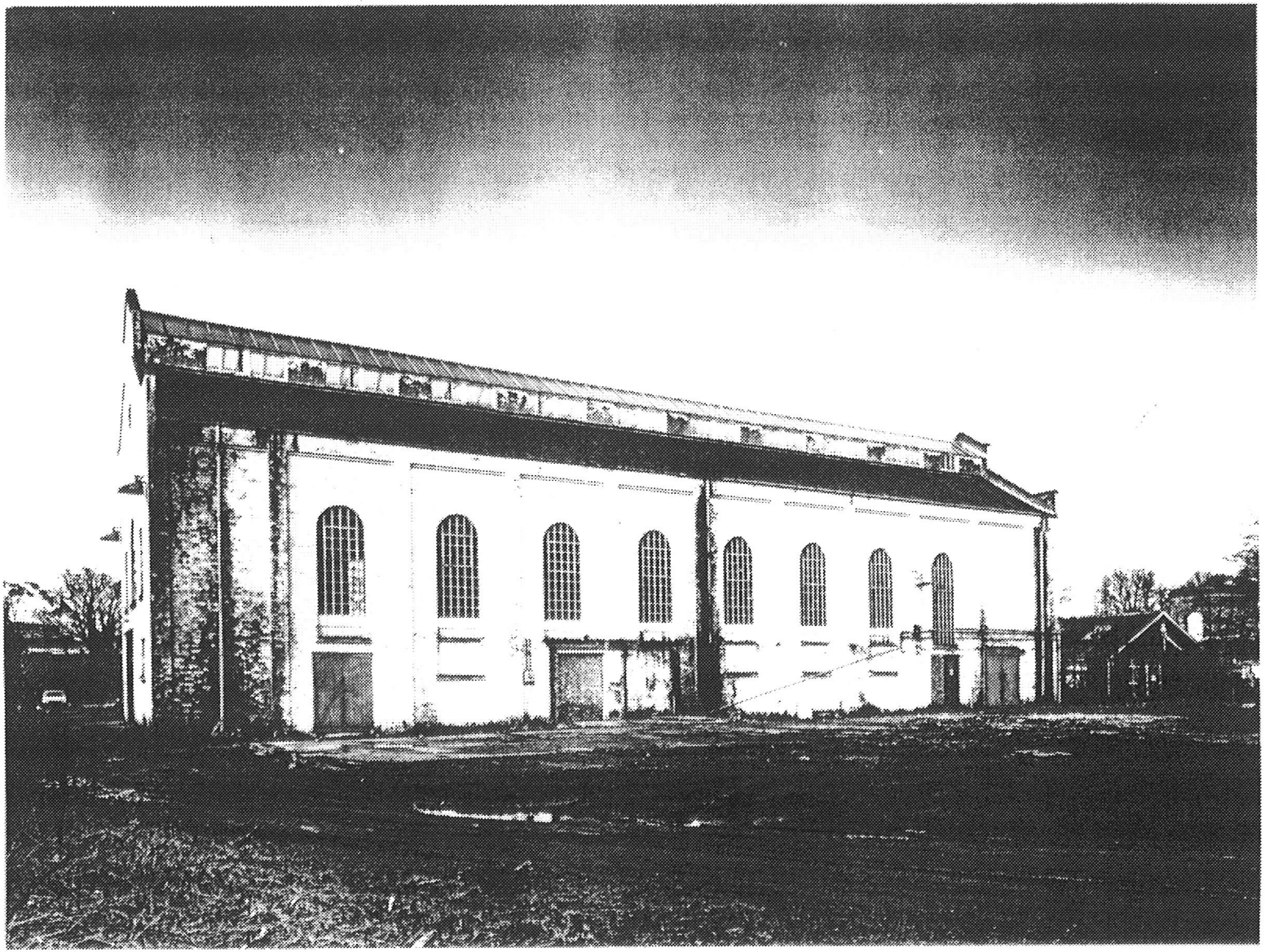


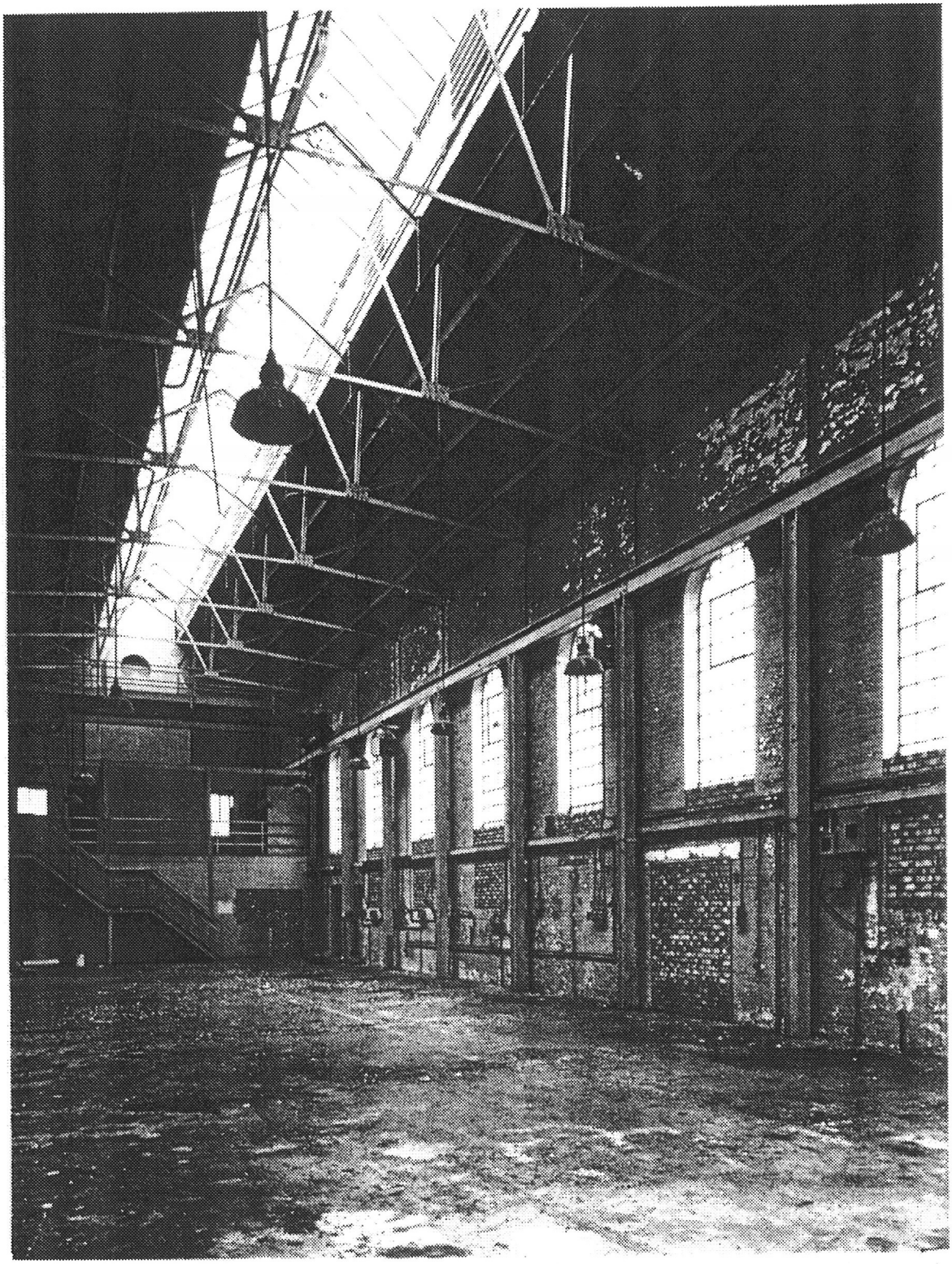








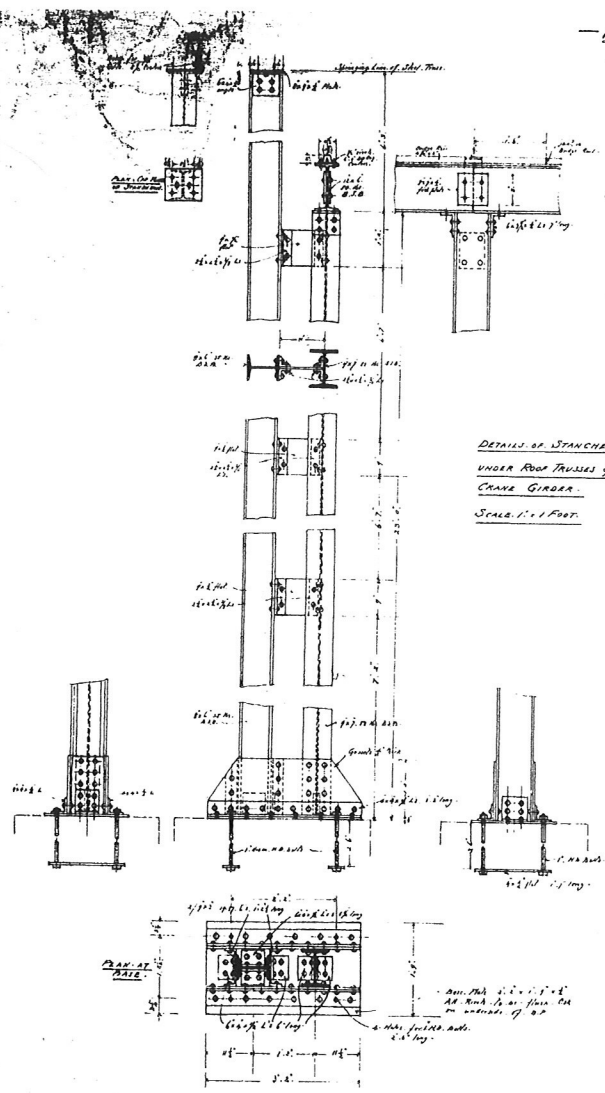




—R.G.P.F. WALTHAM ABBEY—

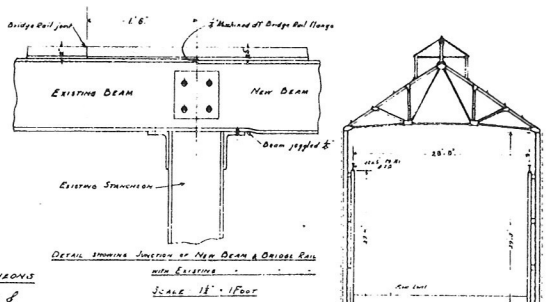
—EXTENSION TO POWER HOUSE UPPER WORKS—

—DETAILS OF STEEL STANCHEONS—



DETAILS OF STANCHEONS UNDER ROOF TRUSSES & CRANE GIRDER.

SCALE 1" = 1 FOOT.



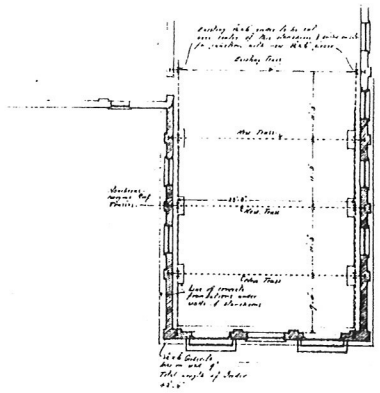
DETAIL SHOWING JUNCTION OF NEW BEAM & BRIDGE RAIL WITH EXISTING

SCALE 1½" = 1 FOOT

—SECTION—

PLAN & SECTION SHOWING POSITION OF NEW STEEL TRUSSES & STANCHIONS —

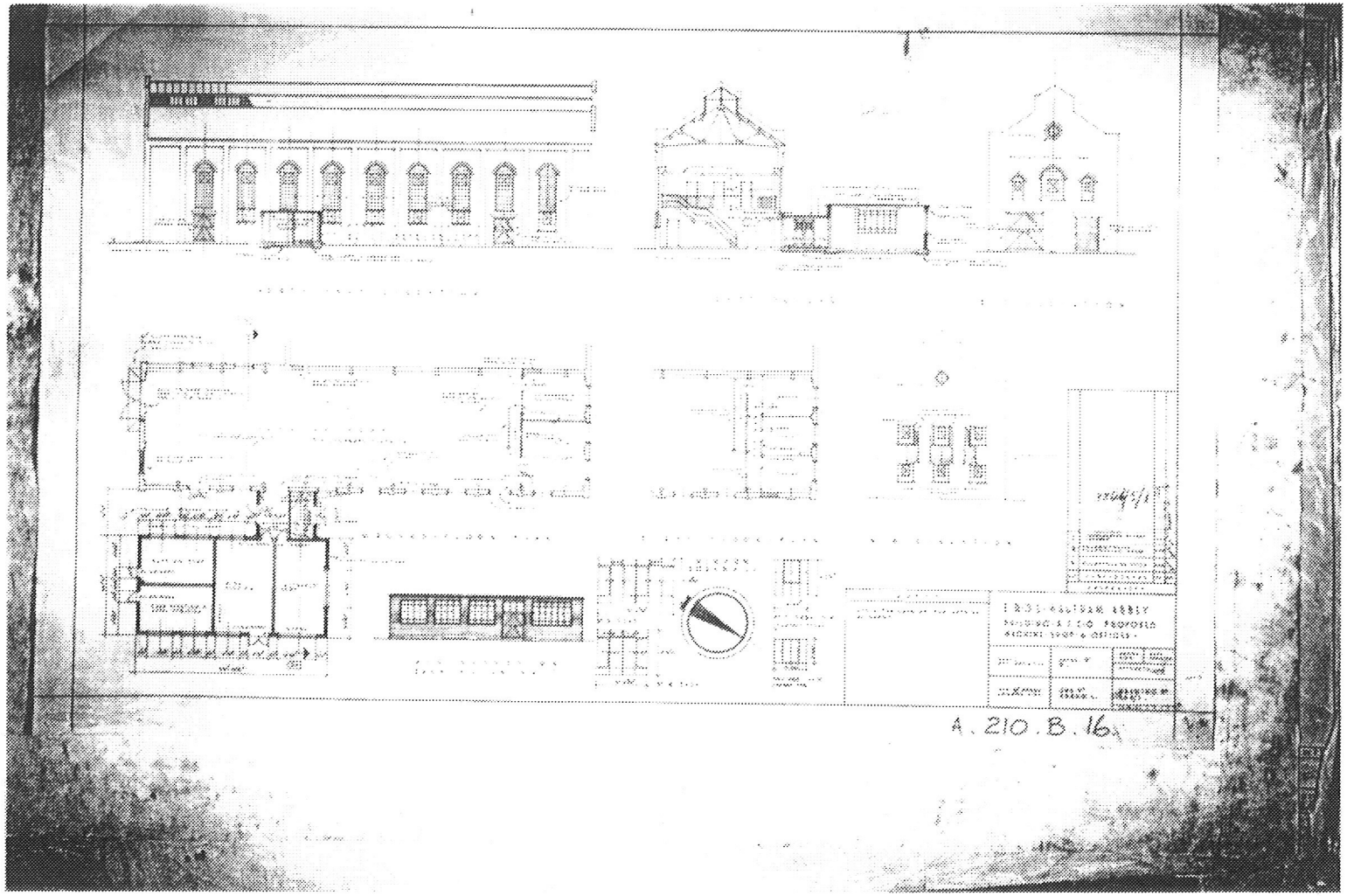
SCALE ⅛" = 1 FOOT.



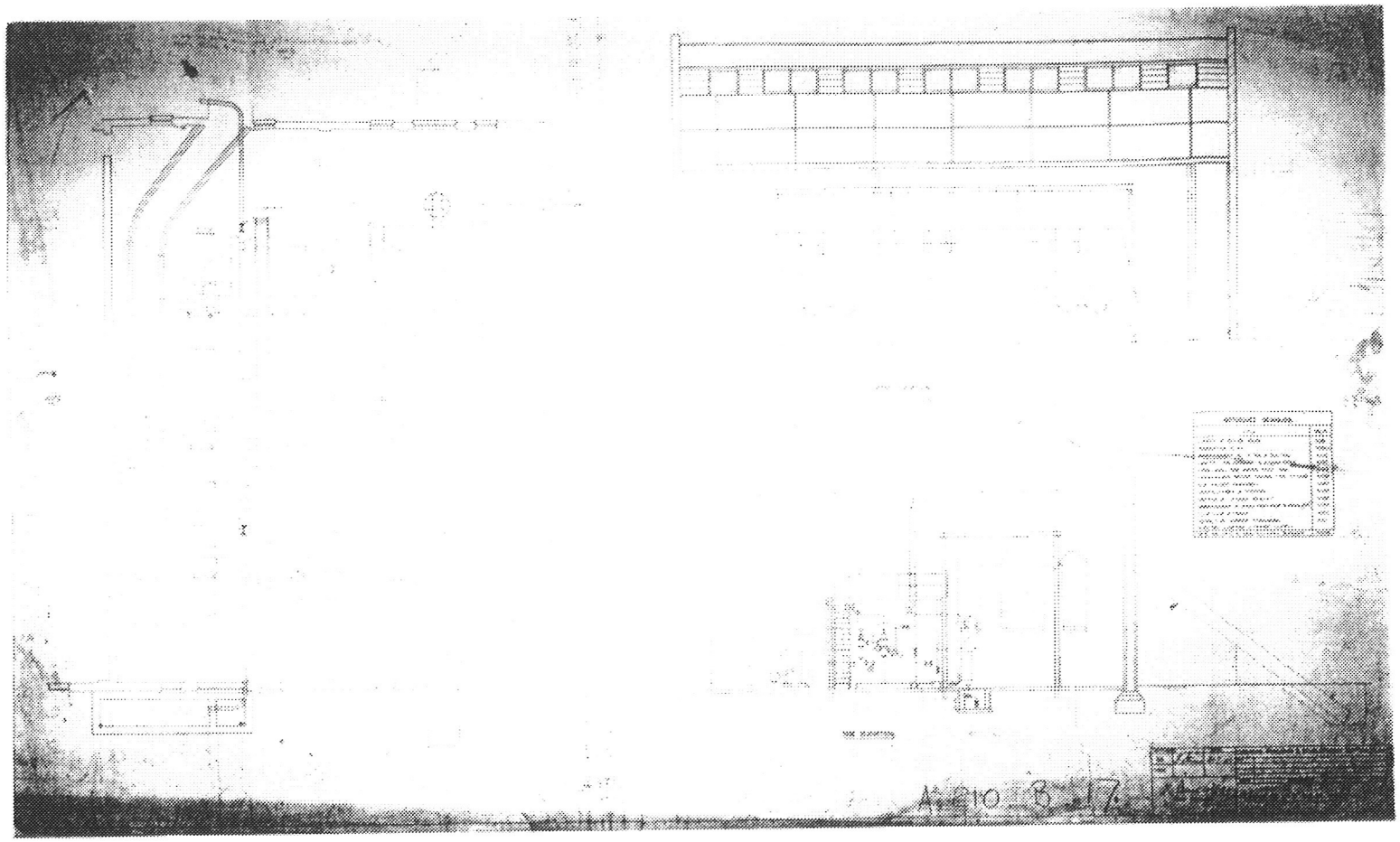
—PLAN—

AE-210/4

A 210 B 04 DRAWING No M.792.



A.210.B.16


A-210 B-17

For matche and leade then for bulletts - - - - xix^{d}
More then for a pownde of powder - - - - - xix^{d}
Payd more that day for powder by Mr Maiors commaundement - - - - - - - - - iiij^{s} j^{d}
To the drummes & phyf at the musters - - - - iiij^{s} vj^{d}
Payd to the xx soldyours then for ij dayes - - - xiij^{s} iiij^{d}
To Mr Ower and Nicholson conductors of them - - ij^{s}
To the Wallon drumme for the day of the musters at Berham Downe - - - - - - - - xij^{d}
To Danyell the cutler for cleanyng the corseletts, for lynyng of viij head peces, for cleanyng of vii pikes, and for makyng cleane of nyne murrions - - xviij^{s}
For mendyng the towne peces and their flaskes - xxiv^{s} iiij^{d}
Payd to the xx trayned shott for there three days trayning this yeare - - - - - - - - - xl^{s}
To Edward Newchuche when he went to Sandwich with Mr Maior to shote there - - - - - - v^{s}
Payd upon the comyng of the gentlemen of Rye with their company, with a company of souldyours, to meet & skyrmysshe, first xv pounde of powder at xiiij^{d} the pounde - - - - - - - - - xvij^{s} vj^{d}
Then for ij pounde of matche - - - - - - xx^{d} ob.
That nyght pay^{d} for their whole supper beyng abowte the nombre of fower score persons then suppyng at the signe of the Swan - - - - - - iiij^{li} ij^{s}
More payd for wyne the nexte nyght following - - v^{s}
Payd more then for v^{li} of powder - - - - - v^{s} x^{d}
More for matche, di. a pounde - - - - - ij^{d} ob.
More for powder at their farewell ij pounde & di. - - ij^{s} xi^{d}
Payd hym that playde on the drumme that dwelt without Westgate - - - - - - - - - xij^{d}
For browne paper to wrap the powder in - - - - j^{d}
For wyne caryed to be dronck without Wynchepe gate at the Rye mens farewell - - - - - - ij^{s}
Payd to one to play wyth the drumme on Holly crose day when the xxx callyver men shewed them selves in the Friers & after went to Mr Mayer - - - xij^{d}
For bryngyng a hoggshead of powder and a sacke of matche from Feuersham to Canterbury - - - xxij^{d}
For buyldyng the tents at the musters, & the boys drumme that day - - - - - - - - - xxij^{d}

For makyng the tents at the hill ayenst an other muster -
For a case for the enseign - - - - - - - - xij^{d}
For a gallon of Sack to Capitayn Skynck - - - - iij^{s} iiij^{d}
To Hodge for wearyng the Armour at the Halle to Berham Downe - - - - - - - - - - iiij^{d}
For double heddyng ij drummes & for the stuff - - iij^{s} iiij^{d}
Payd at the Cheker for Mr Maior & Captayn Palmer, being muster master, and the rest of the commissioners, for their dynner to the number of xxvij at xvj^{d} the pece - - - - - - - - -
For xv mens dynners offycers & seargeants at vj^{d} the pece
For xi offycers and servyng men their dynner - - - v^{s} vj^{d}
For brede and dryncke sent to Captayne Brome to the hill xij^{s} xj^{d}
For powder to shote of the olde peces - - - - xij^{d}
To a labourer for carryeng & recarryeng the tallies and fourmesto & from Babbs Hill, when the muster was toke of the bowes of this cytie - - - vj^{d}
Payd to the trayned shott when they went to Margate - vj^{s} viij^{d}
Payd to Newchurche for heddyng the drumme & other his paynes taken with the Souldyers - - - - x^{s}
To the souldyers of Sandwich a pounde of sugar & a gallon of Wyne - - - - - - - - - iiij^{s}
For Mr Penny for mony layd owte by hym beyng maior in a matche of shootyng - - - - - - - ix^{s}

In the Armada year (1588) a camp was formed at Northbourne, to watch the coast and to prevent a landing of the Spaniards upon the flat shore between Deal and Ramsgate. To the camp flocked the several companies that formed the East Kent Battalion, Canterbury contributing two hundred men led by Alderman Brome, whose namesake commanded the band sent to reinforce Edward IV in 1470. The Canterbury contingent consisted chiefly of bowmen and billmen, the latter armed with weapons and corslets served out from the Guildhall; but, besides these were twenty "trayned shott," or "calyver men," who, in skill and appointments, approached the soldier of the present day. The Walloon "Estraungers," who had

Cowes Hammerhead crane threatened

IA News 133 P. 16

This Grade II listed crane is now in danger of being pulled down.

The 80 ton crane was erected in 1912 for Cowes shipbuilders J. S. White by Babcock and Wilcox of Renfrew

Lynne Lennard

From: "Lynne Lennard" <l.lennard@royalgunpowdermills.com>
To: "Rob Hall" <RobHall@hillresidential.co.uk>
Sent: 13 February 2007 12:12
Attach: image001.jpg; ATT00019.html
Subject: Re: [*] dwg refs.

Hi Rob,
Thanks for the lists of drawings etc. I will make sure that they are available for Graham to collect at 15.00hrs. If you could ask him to come to our visitor entrance in Beaulieu Drive, he can then collect from the shop and ticket office there. When he arrives at the gate he will be seen on CCTV and my colleague Lynn Duke will make sure that he gets them.

Regards
Lynne Lennard

----- Original Message -----
From: Rob Hall
To: l.lennard@royalgunpowdermills.com
Cc: Graham Wilson ; Rachel Livings
Sent: Tuesday, February 13, 2007 11:46 AM
Subject: FW: [*] dwg refs.

Hi Lynne

Thank you for your cooperation.

The email below lists the drawings that the architect would like (those in bold they already have).

We would also like to copy the Royal Commission - National monuments record A4 sheets of printed report.

The photographs that we would like have numbers WAI 1014 05, 06 and 07 plus WASC 1582.

My colleague Graham Wilson will arrive to collect them by 15.00 pm.

Could you arrange for him to get in to the site or should he phone the number on the gate.

We will return them all to you once they are copied.

LIST OF ITEMS COPIED BY Collected 8/2/07.

Regards

Rob

ROB HALL, of HILL RESIDENTIAL/ RACHEL LIVINGS - PTE architects

---

From: Rachel Livings [mailto:Rachel.Livings@ptea.co.uk]
Sent: 13 February 2007 10:32
To: Rob Hall
Subject: [*] dwg refs.

Dear Rob,

Drawing references from yesterday;

A.210.B.15 ✓

" B.16 ✓

" B.17 ✓

" B.28 ✓

" B.29 ✓

" B.35 ✓

" B.59 ✓

Referred to in the report you read were - as Les's List some of the above plus ~~B.01, B.04~~, B.21, B.23 & B.33.

~~B.07, B.32, B.08~~, B.10, B.11 and ~~B.33~~

Anything in bold I have just checked with the set Allan Dunsmore supplied to us and found that we already have.

13/02/2007

Regards

RACHEL.

POLLARD THOMAS EDWARDS architects

Diespeker Wharf, 38 Graham Street, London N1 8JX

020 7336 7777 T 020 7336 0770 F www.ptea.co.uk

John Wilson,
173 The Hornbeams,
Harlow,
Essex CM20 1PL.
Tel. 01279 426690
15/6/06

Mr. W. D. Cocroft,
Dear Wayne,

I haven't had the pleasure of meeting you, but as a volunteer for the Royal Gunpowder Mills, your name is often mentioned as an authority on the mills. I also know you by way of your two books, Dangerous Energy, which is sitting on my desk as I type this letter and Cold War, which is sitting in the bookcase behind me.
My reason for writing is to see if you can shed any light on the Gunpowder Mills Powerhouse, which you mention only briefly in Dangerous Energy.

My interest has been aroused, and I intend to produce a display board for visitors, because of a photo lent to me by our volunteer archivist, Les Tucker.
The photo, see copy enclosed shows the powerhouse (according to the information on the back of the photo) in 1908. However I have problems with the 1908 date. As you will see from the photo, the photographer is almost certainly standing on the platform of the travelling gantry crane. So problem one, the crane in the powerhouse has a manufacturers date of 1915. Therefore is the crane a replacement for an earlier one, or is the date attributed to the photo wrong?

Second problem, is the photo in Dangerous Energy which says "the projection to the Engine room was added in 1916".
I have examined the internal of the powerhouse and can see no sign of the building being extended, which given that we were in the middle of a world war, I would expect to see, after all, the concrete E traverse was cast in 1882 with the extension in 1884 and the two casts are noticeably different.
Pointers I would expect being brickwork mismatch, certainly signs of where the old end wall had stood before being knocked down, variations in the structural steelwork of the building etc. But there is nothing.
So could the projection have all read been there, Much as some drawings of Group C mill show it with only 4 incorporating bays?
And could any extension in fact refer to new generators or other equipment, particularly as the gantry crane has the date 1915 cast into the manufacturers plate (John Smith (Keighley) Ltd.) as well as the Babcock & Wilcox Contractors plate?
There must have been some major revamp going on at the time, as Babcock & Wilcox would be unlikely to get involved unless there were major works afoot, such as boiler and/or generator replacements.
Finally, I haven't found any reference in Dangerous Energy, but do you know when the original powerhouse was built?

I look forward to seeing your comments on the above,

Yours Sincerely,

John Wilson

John Wilson,
173 The Hornbeams,
Harlow,
Essex CM20 1PL.
Tel. 01279 426690
15/6/06

P.S.
I enclose a photo of the crane & makers and Contractors plates. Sorry for the quality, but the printer decided to run out of Magenta ink.

Points of note on the 1908? photo:
The powerhouse is on two levels with the generators on the upper floor.
The switch board is now an office in my photo of the crane.
Note the 3 small generating sets on the left of the photo, and the fact that the nearest of the tree, has no generator fitted.
The Bruce Peebles generators are of a very early type and (again) this leads me to wonder if Babcock were in the process of updating the plant in 1915/6.

Details written in pencil on the back of the original photo are:
Powerhouse photo of 1908, Photo 1582, RCHME Report P. 153 1993.

John Wilson,
173 The Hornbeams,
Harlow,
Essex CM20 1PL.
Tel. 01279 426690
13/06/2006

Dear Les,

Further to the Powerhouse photo, I now think it safe to say that the photo was taken in 1915/16 and not 1908 as suggested in the note on the rear of the photo.
Let me explain my reasoning.
Firstly, I am convinced from the evidence contained in said photo, that the photographer was standing on the travelling platform of the gantry crane.
I see no other way that he or she could get up that high above the machinery and the gantry would make an ideal and easily reached platform to work from.
If we except that this is what happened, then the date for the photo cannot be 1908, as the crane's manufacturing cast iron plate (see photo) has the date 1915 very clearly cast on it.
The only way I can see that the photo could be earlier, is if the crane was up-rated in 1916, when Wayne Cocroft says (Dangerous Energy) the powerhouse bay was extended and that the photo was taken from an earlier crane.
Question, do we have a date for the original building of the powerhouse complex? I have been through Dangerous Energy, but can find no information.

regards,

John Wilson

John Wilson,
173 The Hornbeams,
Harlow,
Essex CM20 1PL.
Tel. 01279 426690
13/06/2006

John Wilson
173 The Hornbeams,
Harlow,
Essex Cm20 1PL.
01279 426690
12/6/06

The Editor,
Old Glory,
Dear Colin,

I wonder if you would be interested in publishing the enclosed photo from 1915.

The photo shows the power station at the Royal Gunpowder Mills north site, with three Bruce Peebles 30VDC 200Kw generators on the right, note the nearest is running.
There are also three smaller generators on the far left of unknown make.
Note the nearest has had its generator removed, or is it waiting for it to be fitted? Our archive throws no light on this.
All though the photo was taken in 1915, the generating plant was installed some time in the late 1880s to replace the individual twin cylinder compound beam engines that were used to drive the various machines around the north site.
Steam was supplied by fifteen Lancashire Boilers 30ft x 8ft in size, delivering steam at 100psi. The boiler house supplied steam for heating and explosive processes through out the northern site as well as for powering the generator house.
There were two 30hp Compound beam engines which were supplied by Benjamin Hick & son between 1856 and 1861. A further three, of unknown make were supplied between 1867 and 1888 all five engines being installed to drive individual mills for the manufacture of gunpowder, and later for cordite production.
There was a small beam engine of unknown size or make, though since it was installed at the same time as the first of the Benjamin Hick engines, I would assume it was by the same maker, and was used as a backup to a water mill that incorporated (mixed) Gunpowder up till the start of 1941.
There were at least two engines of unknown type used to drive fans for the various drying stoves around the site and one to drive the hydraulics for two accumulator towers and their associated press houses.
So as you can see, the introduction of a central power house did away with lots of individual, steam engines, as each engine had its own boiler house and staff.
Sadly non of the beam engines survived the changeover to electricity, any more than the generating plant survived the change to the national grid.
Ah well, such is progress.

I have emphasised the northern site in the above description, because in 1885 land was purchased to the south of Waltham Abbey to build a new chemical explosives factory, which had its own power and boiler house, the only link with the north site being an 18inch (hand pushed) narrow gauge railway. Petrol/Paraffin and battery locos not being introduced until 1916.

I enclose a number of photos of the power house as it is now.
Photo 1 shows the Northern elevation. Note the tower to the left of the main building. This is one of the two accumulator towers for hydraulic power on the site.
Looking at the main building, the narrow bay to the left is the generator house, the two wider bays (which are actually one building) to the right are the boiler house. Note the canal running along the back of the buildings.

Photo 2 shows the southern elevation with the generator house extending out beyond the boiler house. The road in the foreground is relatively modern, and would have been a canal basin to bring coal into the boiler house in its hay day.
Evidence of the basin can still be seen close to the building.

Photo 3: is of the generator room, looking towards the control panel shown in the 1915 photo. The only survivor from that period is the gantry crane, which is in remarkably good condition, considering the years of neglect.

Photo 4: is the crane's lifting capacity plate.

The manual gantry crane of 10 ton capacity, is date 1915, so may have been a new installation at the time the main photo was taken. The crane is still in the generator house, and from the angle of the internal photo, I think the photographer was standing on the crane. The heavy girder to the right and above the generators is one of the tracks for the gantry.

Photos & text are also on the enclosed CDR disc, which I would like back at your convenience. All photos other than the main one, have been taken by myself. There are a number of other photos on the disc, of the boiler & generator houses as they are today, some of which may be of interest.

My thanks to Les Tucker, our volunteer Archivist, who loaned me the main photograph and supplied the boiler and generator information.

Yours Sincerely,

John Wilson
Volunteer for the Royal Gunpowder Mills.

John Wilson
173 The Hornbeams
Harlow
Essex
CM20 1PL

Dear John,

Powerhouse A210

I have enclosed a description of the powerhouse compiled by my colleague Robyn Burgess in 1993. I have also copied photographs of a few of the drawings of the building, the originals may be on site or they may be within the material held by the National Archives, Kew. Les Tucker should be able to advise you.

We dated the power house to between 1908 and 1915, so if this is correct the date on the photograph may be incorrect. There was another powerhouse of similar date on South Site (approximately where the new distribution depot sites), there is a slight chance that this view shows that building. It may be worth looking at the building ledger WASC 1509 as I think this shows the original rectangular form of the powerhouse and thumbnail sketches of the rest of the factory. The references in the 1993 RCHME text should allow you to reconstruct the history of the building.

Prior to the construction of A210 most electrical power appears to have been locally generated by attaching a generator to a convenient steam engine. I think the construction of A210 marks the general conversion of the factory to electrical power. The 1993 RCHME report on the site contains more information on the power sources.

Yours sincerely

COPY.

Wayne Cocroft

Cc Lynne Lennard

John Wilson,
173 The Hornbeams,
Harlow,
Essex CM20 1PL.
Tel. 01279 426690
10/6/06

Dear Les,

Many thanks for the loan of the Powerhouse photo, which I find fascinating. I have copied the photo to disc and will make a display board to go somewhere near the bridge by the side of the cafe, so that visitors can find out what the building was for. I enclose a copy of the photo as an additional ref. for you.
Points of interest, the Nearest Bruce Peebles set is running. They are twine cylinder compounds, with the high pressure cylinder nearest to the photographer and the low pressure cylinder (with the extension out the back) on the far side of the generator. I must say I have never come across generating sets where the generator is connected directly to the cranks like this. It must make it a pig of a job to remove a generator, as you are effectively stripping the entire engine, with cranks, connecting rods and fly wheel having to be removed to get at the generator.
On the left hand side of the photo, towards the rear, there are three small generating sets, with the nearest one partially stripped down. They appear to be twin cylinder engines (possibly compounds) of a marine type. Note the more conventional way the generators are mounted, coupled to the fly wheel, so that the generator can be removed without touching the engine.
I think I will send a print to Old Glory magazine, they like this sort of picture.

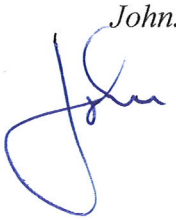
On a different tack, Norman Paul spoke to me today about the Beam Engine Book, and he said you had some doubt about Watt's claim to have invented the centrifugal governor.
I presume you are referring to the device that Mathew Boulton saw on a visit to Albion Mill around 1788 and wrote to Watt about it?
I would make the point that the Albion Mill device, was not a governor and did not control the speed of the machinery.
Its purpose was to lift the mill stone out of contact with the lower stone, thereby making the mill easier to start. As the mill picked up speed, centrifugal force lowered the upper stone onto the lower, so that the grinding process could start.
Mathew Boulton described this device to Watt after a visit to Albion Mill and Watt used the idea of centrifugal force to produce his governor to control the speed of the 1788 rotative beam engine and all future engines, but to suggest that Watt copied the Albion device would be unfair as they were two different devices, all be it using the same force of nature.
One point, if Watt copied someone else's idea, why didn't they sue him (a pastime much indulged in by inventors/engineers/scientist of the period)? Answer, they were two different devices.

John Wilson,
173 The Hornbeams,
Harlow,
Essex CM20 1PL.
Tel. 01279 426690
10/6/06

One last point, there were governors in existence to control the speed at which machinery ran, prior to 1788, but these were for the most part based on the vane principle where two or more opposed vanes are spun at speed, the air resistance builds up against the vanes and limits the maximum speed at which they will turn. An obvious examples being the vanes in a striking clock. But of course this type of governor would be of no use on a steam engine.

Regards

John.



Copy to Norman Paul